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(56) Documents cited

GB 1483654	US 4099200
GB 0732972	US 4018483
GB 0514702	US 3938217
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(58) Field of search  
A4F(54) **Cleaning apparatus**

(57) The cleaning apparatus according to the invention is provided for cleaning ground or floor surfaces or footpaths or halls, but in an alternative embodiment it can also be used as a snow clearing apparatus. A fan (1,2) produces a strong air flow which is passed through a delivery duct (3) into the vicinity of the ground or floor and is there deflected by a deflector member (10) so that it impinges on to the ground or floor in a direction which is opposite to the direction of movement of the apparatus, whereafter it flows through a conveyor duct (6), entraining the rubbish or snow. The duct (6) opens either into a rubbish container (7) from which the air returns to the air flow circuit, or at a side wall of the apparatus when the apparatus is a snow clearing apparatus.

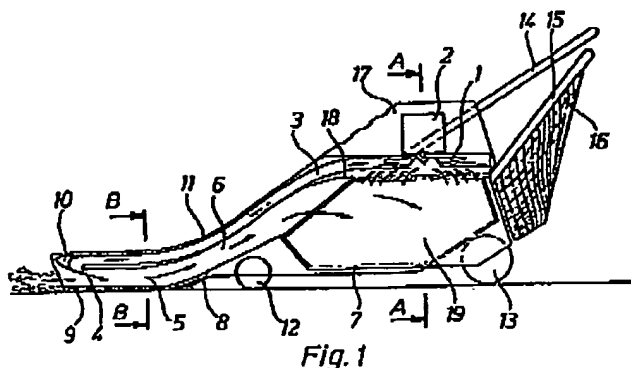


Fig. 1

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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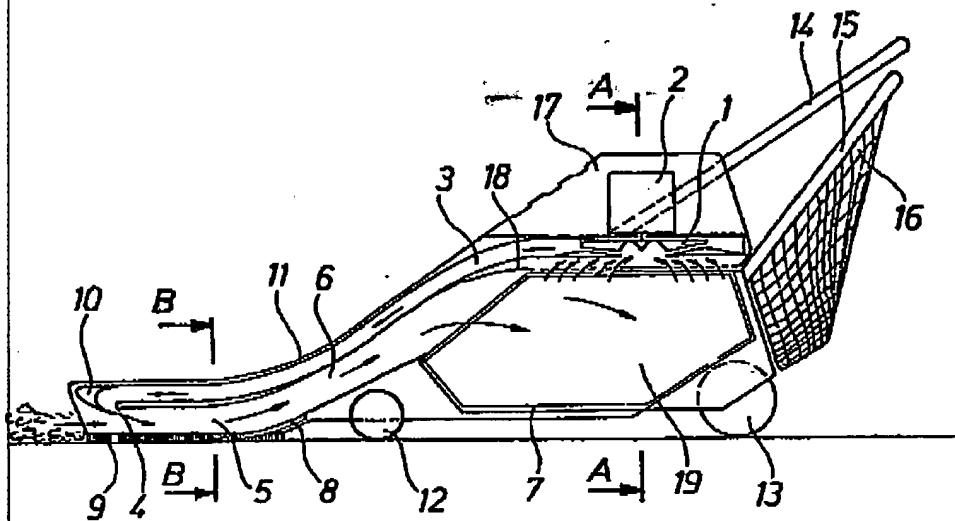


Fig. 1

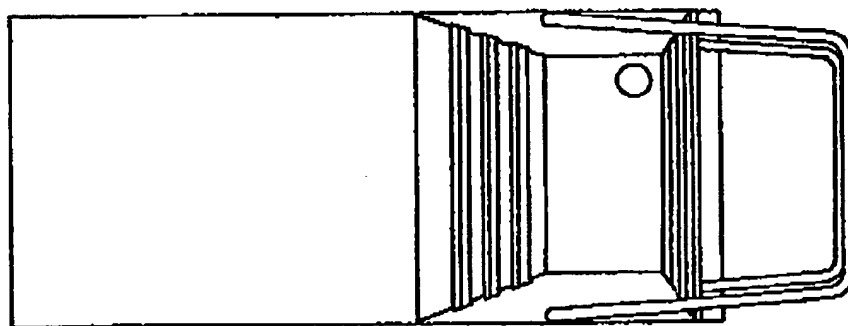


Fig. 2

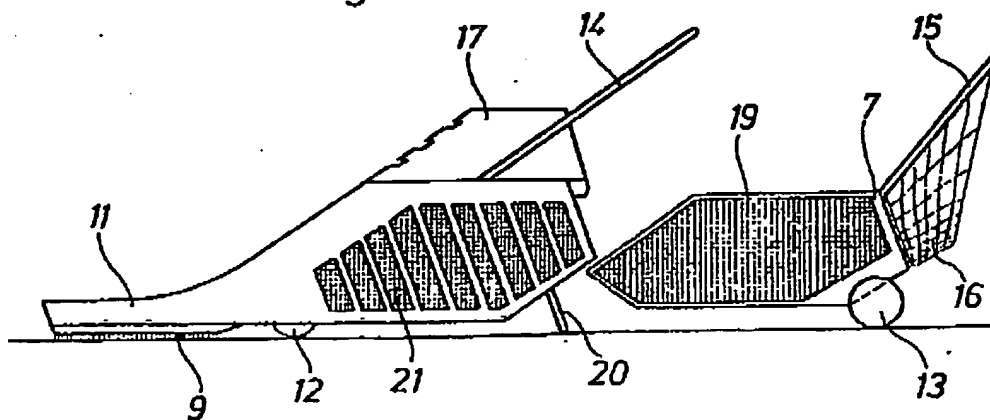


Fig. 3

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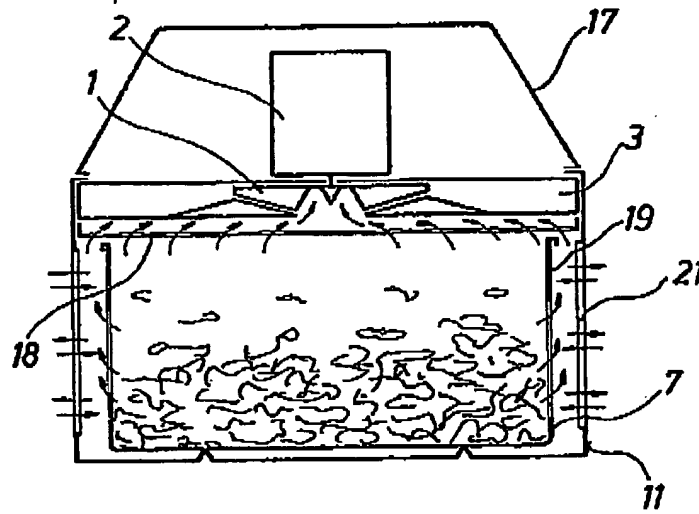


Fig. 4

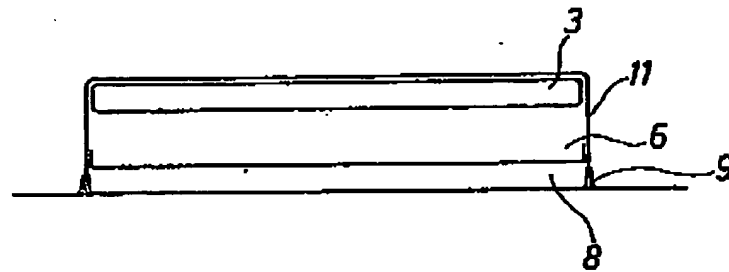


Fig. 5

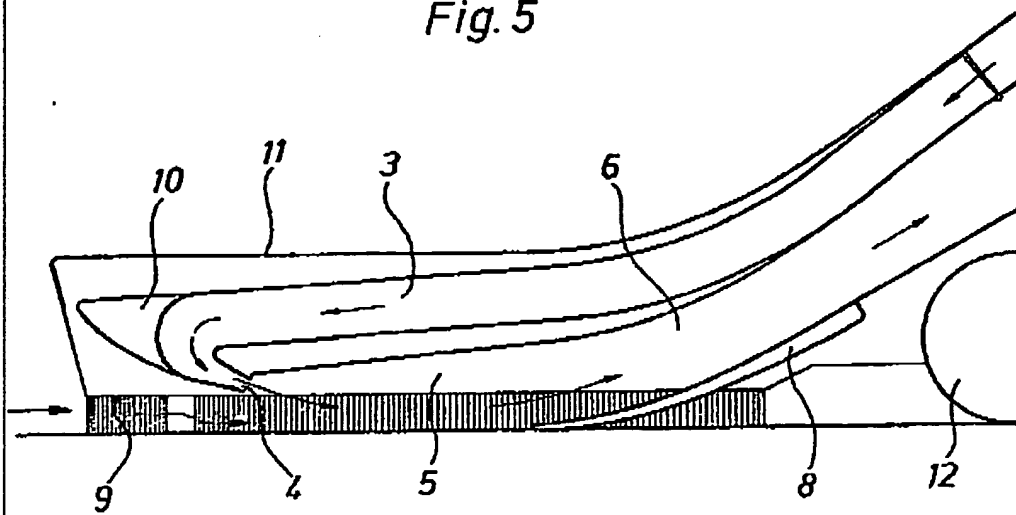


Fig. 6

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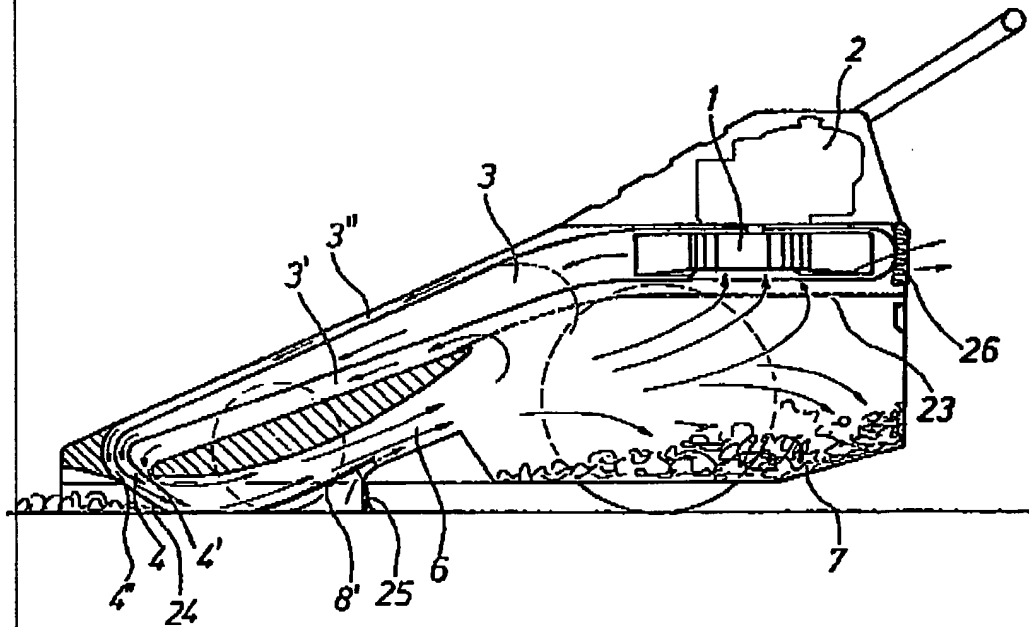


Fig. 7

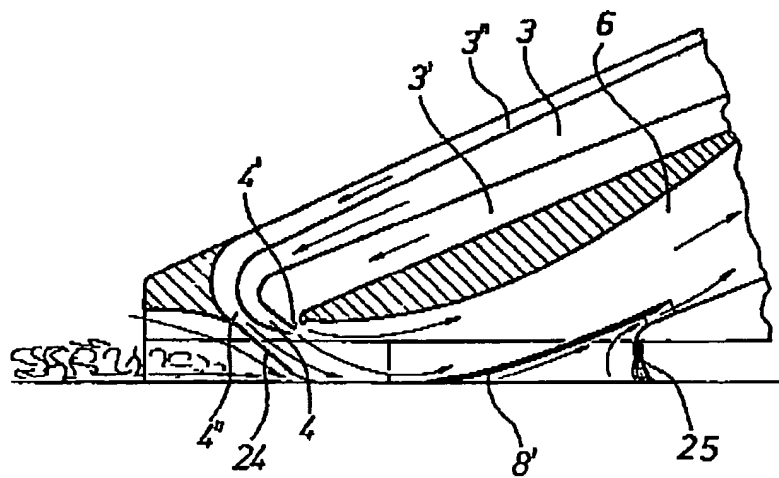


Fig. 8

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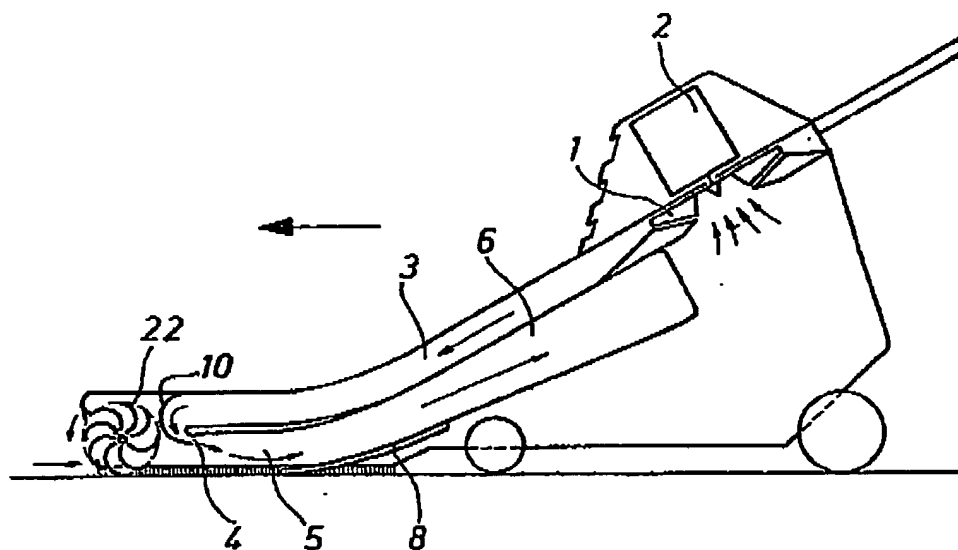


Fig. 9

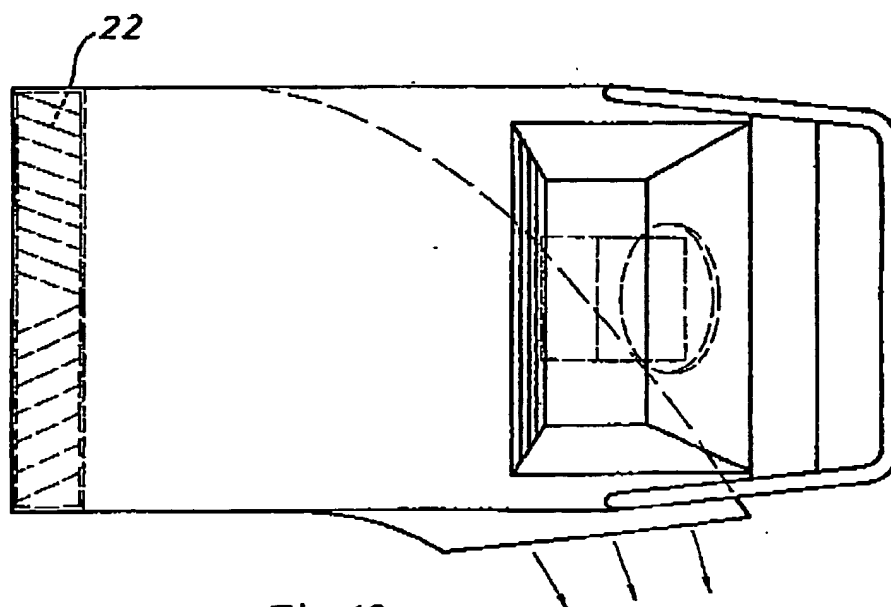


Fig. 10

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## SPECIFICATION

## Cleaning apparatus

5 The present invention relates to a cleaning apparatus which is intended in particular for removing rubbish, leaves and the like on footpaths in streets, parks and the like and on the floor surfaces in premises of larger size such as industrial factories, sports halls and the like; in a modified embodiment, the apparatus can be used for clearing snow.

There is a large number of different forms of cleaning apparatuses for the purpose set forth above, which can be classified in three main groups. Thus, there are cleaning apparatuses which use only movable brushes when carrying out a cleaning operation; that arrangement often uses a combination of horizontal roller brushes and vertical fan-like brushes. Other cleaning apparatuses use only a suction effect, operating in the manner of the suction cleaner which is known for domestic purposes, wherein the air is sucked in at the suction nozzle and discharged into the atmosphere again after passing through the dust bag. The third group of cleaning apparatuses uses a combination of the above-described cleaning modes, that is to say, the rubbish which is collected with the brushes is sucked away by a suction effect.

Upon critically analysing those groups of apparatuses, it can be found that those apparatuses which only use brushes remove small particles of dirt or dust poorly or not at all, whereas, when dealing with larger or heavier rubbish such as for example pieces of glass and metal, their effect is better than the apparatuses which operate with a suction effect, or, to put that more precisely, in order to remove for example a piece of metal of the same weight and size, the apparatus which operates with a suction effect must use a greater amount of power.

The foregoing has made it clear that, although an apparatus which operates with a suction effect is more effective, it consumes a great deal of energy for a given scope of operation.

The problem of the present invention is therefore to provide a cleaning apparatus which, with equally good or even better properties than known apparatuses which operate with a suction effect, will consume less energy, for the same scope of operation.

That problem was solved with the cleaning apparatus according to the invention wherein, depending on the particular use involved, only an increased pressure or an increased pressure combined with a suction effect is used for removing the rubbish or the snow.

According to the present invention there is provided a cleaning apparatus comprising a casing in which is provided an air delivery duct through which the air is caused to flow from a motor driven fan, said air duct terminating at a nozzle through which the air flows, a deflector member being provided for directing the air to flow into an operating chamber and against the ground or floor to be cleaned so as to be deflected by said ground or floor together with the entrained rubbish through a conveyor duct.

Some embodiments of the invention will now be described, by way of examples, with reference to the accompanying drawings, in which:-

Figure 1 is a longitudinal section through the cleaning apparatus of the present invention;  
Figure 2 is a plan view of the cleaning apparatus;  
Figure 3 is a side view of the cleaning apparatus with the rubbish container pulled out;  
Figure 4 is a cross-section taken along line A-A indicated in Figure 1;  
Figure 5 is a cross-section taken along line B-B indicated in Figure 1;  
Figure 6 is a longitudinal section of the front part of the cleaning apparatus, which is fitted thereon, with the nozzle;  
Figure 7 is a longitudinal section of an alternative form of the air guide ducts;  
Figure 8 shows a detail part of Figure 7 on a larger scale;  
Figure 9 is a longitudinal section of an alternative embodiment for use in clearing snow; and  
Figure 10 is a plan view of the alternative embodiment for clearing snow.

The cleaning apparatus according to the invention, which is illustrated in Figures 1 to 6, is intended for collecting rubbish, debris or litter which is collected in a collecting basket. A fan rotor 1 which is driven by a motor 2 produces an air flow at an increased pressure in a delivery duct 3. The direction of the air flow is altered somewhat before reaching a nozzle 4 by a profiled member 10 in such a way that, being transformed in the nozzle 4 into a nozzle jet, it is directed at an inclined angle against the surface to be cleaned, on to which it impinges at a flat angle in an operating chamber 5 and moves on in the direction of a conveyor duct 6. That movement of the air jet produces, in the space directly in front of the nozzle 4, a reduced pressure which contributes to drawing lighter rubbish into the working chamber or space 5. The heavier rubbish passes into the chamber 5 due to the forward movement of the cleaning apparatus and is urged out of the chamber 5 by way of a scraper 8 into the conveyor duct 6, and is carried into a container 7. The operating chamber 5 is closed off on three sides, more particularly, at the rearward side, by the scraper 8 which can be made from rubber, and may be in the form of bristles or the like, while the side walls are formed by a sheet metal casing 11 of the cleaning apparatus itself, which are extended towards the ground by means of a curtain 9; the curtain 9 may also comprise rubber or may be in the form of a brush. The curtain 9 also performs the function, in the cleaning operation, of loosening the rubbish which is stuck in the corners.

The air which is directed into the container 7 with the rubbish escapes through a barrier 18 which is disposed above the container 7 and which is provided with openings, and through the laterally disposed net 19 sides of the container 7, and passes again into the air circuit by way of the fan rotor 1. As there is an increased pressure in the container 7, that has a positive effect on the power consumption of the motor 2. Besides being shown in Figure 1, the course of the air flow is particularly clearly visible in Figure 4.

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A further useful effect occurs when, by virtue of lowering the delivery duct 3 with the nozzle 4 in the direction of the surface to be cleaned, at the same time the spacing of the nozzle 4 from the floor surface, the direction thereof relative to the floor surface and the size of the chamber 5 are altered, thereby increasing the cleaning effect for heavier rubbish. Those changes in the operating conditions can be seen in Figure 1 and in a particularly clear fashion from Figure 6, and such alterations can be made when the cleaning apparatus according to the invention is in operation.

Figure 3 shows a side view of the cleaning apparatus from the exterior, with the rubbish container 7 being pulled out. Reference numeral 20 denotes two legs which automatically move into the position illustrated and which, together with two front wheels 12, form the rearward support or rest of the apparatus, as the two rear wheels 13 are components of the container 7. Also disposed on the container 7 is an arm 15 beneath which is secured a wide-mesh net 16 which serves to collect larger objects which are picked up manually. Provided in the side walls of the sheet metal casing 11 are openings 21 which are covered with a close or dense filter material. The main steering arm 14 of the apparatus carries all control devices of the apparatus, while the motor cover 17 permits easy access to the motor 2.

In a further development of the apparatus, it was found that, when the container 7 is being filled, the air conditions alter so severely that the fan cannot continue to operate in the optimum fashion. In order to eliminate that disadvantage and further to increase the operating effects of the apparatus, two further ducts 3' and 3" were associated with the delivery duct 3, as can be seen from Figures 7 and 8. Of the two further ducts 3' and 3", one duct 3' is arranged beneath the duct 3 while the other duct 3" is arranged above the duct 3. The air passes to those ducts 3' and 3" from the space in the container 7 through a narrow-mesh net 23, moving past the fan rotor 1; the duct 3' opens into a nozzle 4' and the duct 3" opens into a nozzle 4", those nozzles being at both sides of the nozzle 4. The ducts 3' and 3" carry away the excess of air which is produced as a result of the outside air being sucked in by the entrainment effect of the air jet formed by the nozzle 4. In order additionally to eliminate the influence of the air which is sucked in, also disposed in association with the fan rotor 1 is a filter 26 through which a part of the air can escape from the container 7. In this respect, it should also be noted that the air flow generated by the fan rotor 1 is guided in isolation from the filter 26.

An additional improvement in the mode of operation of the apparatus was achieved by incorporating a narrow gap between the lower part of the sheet metal casing 11 and the scraper 8'. Particles of dust which are held up by a brush 25 which extends transversely across the underside of the apparatus are sucked away through the above-mentioned gap. The suction effect is produced by the flow of air which flows at high speed over the scraper 8' and forms a reduced pressure in the gap. That improve-

ment is particularly clearly visible in Figure 8.

As shown in Figure 8, it is also possible to provide an additional component of the apparatus according to the invention, which represents a further step forward from the point of view of improved mode of operation. Disposed in front of the nozzle 4' of the upper delivery duct 3' is a curtain 24 which extends as far as the ground or floor and which preferably comprises a thin rubber member. The curtain 24 prevents an excessive amount of air from passing into the air circuit, but, by virtue of its fluttering or flapping movements, it additionally acts on the rubbish which has stuck to the ground or floor, and thereby assists the action of the air jet.

As already mentioned above, the apparatus according to the invention may also be used as a snow clearing apparatus. The appropriate construction, which is shown in Figures 9 and 10, differs from the basic construction shown in Figure 1 in that the wheel or impeller of the fan rotor 1 with the motor 2 is disposed at an inclined angle at the beginning of the shortened part of the delivery duct 3, whereas the conveyor duct 6 is bent away at an inclined angle from the operating chamber 5 towards the side wall of the apparatus, and opens therethrough to the exterior. Disposed in front of the nozzle 4 in the deflector member 10 is a screw-like cutter 22 which is driven by the motor 2. That loosens up any snow which has possible been trodden-down hard so that it is more easily ejected laterally from the chamber 5 through the conveyor duct 6. The snow clearing apparatus is suitable for clearing fresh snow or a thin layer of trodden down and hard snow.

## 100 CLAIMS

1. A cleaning apparatus comprising a casing in which is provided an air delivery duct through which air is caused to flow from a motor driven fan, said air duct terminating at a nozzle through which the air flows, a deflector member being provided for directing the air flow into an operating chamber and against the ground or floor to be cleaned so as to be deflected by said ground or floor to flow together with the entrained rubbish through a conveyor duct.

2. A cleaning apparatus as claimed in claim 1, in which at its rear the operating chamber is closed off by an elastic scraper, the lower edge of which bears against the ground or floor, the side walls of the chamber being formed by the casing of the apparatus, which is extended to the ground or floor by an elastic curtain.

3. A cleaning apparatus as claimed in claim 1 or claim 2, in which the conveyor duct opens into a rubbish container from which the air passes into the air circuit through openings which are disposed in cover means located directly adjacent the fan rotor.

4. A cleaning apparatus as claimed in claim 3, in which the container is removable from the apparatus and the side walls of the container are formed of a mesh and openings which are covered with filter means are provided in the side walls of the casing.

5. A cleaning apparatus as claimed in claim 3 or claim 4, in which the air which issues from the container is passed through two ducts which are

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positioned below and above the delivery duct, said two ducts terminating in nozzles which are disposed at both sides of the nozzle of the delivery duct, said air passing through said nozzles of the two ducts into the general air flow in the conveyor duct, the two ducts being connected to the exterior of the apparatus in the vicinity of the fan through a filter.

6. A cleaning apparatus as claimed in any one of claims 2 to 5, in which formed between the scaper and the lower part of the casing is a gap which opens into the conveyor duct, and secured to the lower edge of the casing is a brush which extends to the ground or floor and a curtain which extends transversely across the apparatus is secured to the deflector member in front of the nozzle.

7. A cleaning apparatus as claimed in claim 1 or claim 2, in which the conveyor duct is curved sideways and opens into the free air in a side wall of the casing, and disposed in front of the deflector member is a screw-like cutter which is driven by the motor of the apparatus.

8. A cleaning apparatus substantially as hereinbefore described with reference to and as illustrated in Figures 1 to 8 or Figures 9 and 10 of the accompanying drawings.

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